

REMARKS

Status Summary

Claims 1-14 are pending in the present application. Claims 1-14 presently stand rejected. Claims 1, 5 and 8 have been amended herein.

Claim Rejection - 35 U.S.C. § 112

Claim 8 is rejected by the Examiner under 35 U.S.C. § 112 because there is insufficient antecedent basis for the limitation "when said plates are biased with different voltages". Applicant has amended claim 8 such that the word "plates" has been deleted and replaced with the word "members". In view of this amendment, applicants respectfully submit that claim 8 now complies with 35 U.S.C. § 112, and respectfully requests that the rejection to claim 8 be withdrawn at this time.

Claim Rejection - 35 U.S.C. § 102

Claim 1 is rejected by the Examiner under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,576,540 to Jolliffe (hereinafter "Jolliffe"). Applicants respectfully traverse the rejection to claim 1 because Jolliffe fails to teach each and every element recited in claim 1.

As a general matter, the present application discloses an integrated ion focusing and gating device for use in a mass spectrometer. Many mass spectrometer-based systems utilize an ion trap to select ions for passage to an ion detector. An ongoing challenge in the design of such systems relates to the desire for reducing noise so as to improve the quality of data acquisition. One way to control throughput in the system in a manner that reduces noise is to use one or more optical components that serve as a gate or gates to stop ions from entering the ion trap during the scanning process. The present application summarily describes the problem and prior art approaches to gating at page 1, lines 26-33 to page 2, lines 1-2 as follows:

Hence, the kinetic energy of droplets moving at nearly the same velocity as the gas will have very high kinetic energies due to the large mass of the droplets. It is undesirable to allow these charged droplets to enter the trap when the trapped ions are being scanned out for detection. The droplets will cause large noise spikes that obscure the spectrum ... Prior art devices have used one of the focusing electrodes as a gate to

stop ions from entering the trap during the scanning process by applying a large repulsive potential to stop the ions from passing through the lens. However, this requires the charged droplets to stop and reverse direction to avoid entering the end cap hole which creates background noise in the detector.

The present application discloses embodiments which address this problem in a manner distinct from the prior art of record. As a general matter, the present application discloses a two-member deflector lens element (designated 26 in the examples shown in Figures 1 – 3) that performs a gating function between an ion guide and an ion trap. This deflector lens is configured to operate in at least two different states. The first state allows ions to pass through the detector lens into the ion trap in preparation for scanning. The second state prevents ions from passing into the ion trap while existing ions in the ion trap are being scanned. These two states are realized by applying certain voltage potential schemes to the deflector lens, one example being graphically expressed in Figure 4 of the present application. The present application at page 2, lines 12-17, provides a summary of the deflector lens as follows:

When it is desirable to fill the ion trap with ions, the voltage applied to the two halves of the deflector lens are identical, and the lens functions as a focusing lens.

When it is desired to prevent ions from entering the entrance hole of the end cap, the two halves of the lens are set at large potentials with opposite polarities. Thus, ions are deflected off from the axis of symmetry or axis of focus and away from the entrance hole. By gating ions with the split deflector lens, background noise in a detected spectrum is reduced.

Claim 1 recites an "integrated ion focusing and gating lens" comprising "first and second members forming a generally cylindrical configuration about an axis for focusing ion flow along said axis when each said member is biased with the same voltage and for deflecting an ion flow when each said member is biased with a different voltage." Jolliffe fails to disclose a focusing and gating lens having such first and second members. Referring to Figure 1 in Jolliffe, Jolliffe discloses the use of a conventional plate (40) for gating ions upstream of its ion trap (32). As with similar conventional lens devices, plate (40) prevents the passage of ions by reflecting the ions back along its

axis (i.e., reversing the direction of the ions) and not by deflecting the ions off axis. The only deflection of ions that occurs in the apparatus disclosed in Jolliffe is by the ion trap (32) itself, after the ion trap has already been filled with ions, which is opposite to what occurs using the lens recited in claim 1. The use of an ion trap to deflect ions cannot serve to deflect ions away from the ion trap. Moreover, Jolliffe fails to disclose a gating device comprising a generally cylindrical configuration of first and second members.

The minor amendments to claim 1 have been made herein for purposes of consistency in language and not for any purpose relating to patentability.

In view of the foregoing, applicants respectfully submit that claim 1 is patentable over Jolliffe under 35 U.S.C. § 102(b), and respectfully requests that the rejection to claim 1 be withdrawn at this time.

Claim Rejection - 35 U.S.C. § 103

Claims 1-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Jolliffe in view of U.S. Patent Application Publication No. 2002/0121594 by Wang (hereinafter "Wang"). The Examiner contends it would have been obvious that the mass spectrometer of Jolliffe could be modified to use a multipole ion guide apparatus in accordance with Wang if so desired. Applicants respectfully traverse this rejection because the teachings of Jolliffe and Wang fail to teach, suggest or provide motivation for each and every element recited in the rejected claims.

As an initial matter, the use of the ion guide disclosed in Wang fails to cure the deficiencies of Jolliffe with respect to the rejected claims. Referring to Figure 6 of Wang, Wang discloses a series of multipole ion guides and, similar to Jolliffe, conventional, transverse plate-type gating electrodes such as a first gating electrode (179), a second gating electrode (174), and a third gating electrode (176). These gating electrodes could be used to prevent ions from passing therethrough along the axis of the apparatus by reflecting the ions back along the axis, but not by deflecting the ions off from the axis. The only deflection of ions in Wang occurs within the mass analyzer (163). Specifically, an ion accelerator (197) within the mass analyzer (163) can accelerate ions orthogonally relative to the axis along which the ions are inputted into the mass analyzer (163). However, as in the case of Jolliffe, such deflection occurs only after ions have been trapped by the upstream ion trap devices (153) and (161). In addition, Wang fails to disclose a gating device comprising a generally

cylindrical configuration of first and second members. Thus, Wang can be distinguished in the same manner as Jolliffe as discussed above in connection with the rejection of claim 1 under 35 U.S.C. § 102(b).

Independent claim 1 is directed to an ion focusing and gating lens as discussed hereinabove. Independent claim 5 recites a "deflector lens including first and second members forming a generally cylindrical configuration . . . focusing ion flow along an axis . . . when biased with the same voltage on each member, and said members deflecting an ion flow when biased with different voltages." Independent claim 8 recites a "deflector lens having first and second members . . . focusing ion flow along an axis . . . when biased with the same voltage on each member, and said members deflecting an ion flow when said ion members are biased with different voltages." Accordingly, claims 5 and 8 can be distinguished for the same reasons as regards claim 1. Dependent claims 2-4, 6-7, and 9-14 are distinguishable for the same reasons as the claims from which they respectively depend.

A minor amendment has been made to claim 5 solely for the purpose of consistency of language, and not for any purpose relating to patentability.

In view of the foregoing, applicants respectfully submit that claims 1-14 are patentable over Jolliffe in view of Wang under 35 U.S.C. § 103(a), and respectfully request that the rejection to claims 1-14 is withdrawn at this time.

Conclusion

In light of the above amendments and remarks, it is respectfully submitted that the present application is now in proper condition for allowance, and an early notice to such effect is earnestly solicited.

Respectfully submitted,



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